word tokenization

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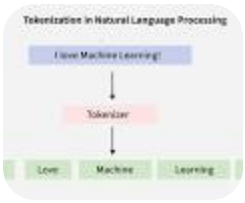

Word tokenization is a foundational step in Natural Language Processing (NLP) that breaks raw text down into individual words or word-like units, known as tokens. This process transforms unstructured human text into discrete, manageable pieces that algorithms and large language models (LLMs) can process, analyze, and convert into numerical vectors.

For example, the sentence *"Machine learning is fascinating"* becomes the list of four word tokens: `["Machine", "learning", "is", "fascinating"]`.

How It Works

At its core, word tokenization relies on specific rules to determine where one word ends and the next begins. The process typically involves:

- **Delimiter Splitting:** Dividing text based on spaces, tabs, or newlines.
- **Punctuation Handling:** Stripping or isolating punctuation (e.g., periods, commas) so they don't attach themselves to words.
- **Case Normalization:** Converting all text to lowercase so the model treats "Apple" and "apple" identically, reducing vocabulary size.

Popular Tools and Libraries

You can easily perform word tokenization using standard Python libraries. Some of the most widely used tools include:

- NLTK (Natural Language Toolkit): Features the highly popular `word_tokenize()` method, which applies rule-based logic to English text.
- spaCy: An industrial-strength NLP library known for fast, robust, and language-aware tokenization.

- **Hugging Face Tokenizers:** Offers highly optimized tokenization pipelines essential for modern transformer models.

Common Challenges

While intuitive, word-based tokenization faces a few limitations that have led to the rise of *subword* tokenization (like Byte-Pair Encoding) in modern LLMs:

- **Contractions and Compound Words:** Handling contractions like "didn't" or compound phrases like "state-of-the-art" requires careful logic to avoid losing meaning or splitting them incorrectly.
- **Vocabulary Size and Out-of-Vocabulary (OOV) Tokens:** In highly inflected languages (like Turkish or German), there are limitless variations of words. Word tokenizers often struggle to understand new, unseen words, treating them as unknown.

Ask anything

I can provide **code snippets** to help you get started.

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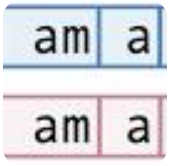

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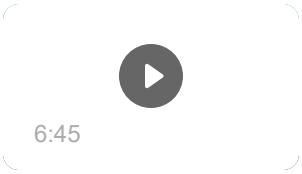

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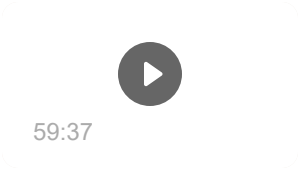

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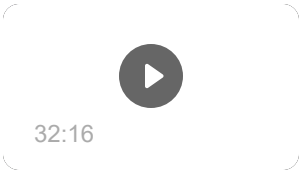

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